CONFERENCE OF THE EIGHTEEN-NATION COMMITTEE ON DISARMAMENT

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Memorandum on international co-operation for the detection of underground nuclear explosions

In view of the efforts being made to extend the partial test ban to cover also underground nuclear tests, the question of improving existing facilities for monitoring seismic events has received increased attention. The scientific advisers, attached to the Swedish delegation at the ENDC, a few months ago presented a discussion paper on extended international co-operation in seismology for detection purposes ("detection club"). The Swedish delegation has the honour to present to the ENDC for information its views on this subject.

Underground nuclear explosions do not, as a rule, generate global distributions of easily detected radio active debris. So far the seismic method seems to be the only technical way to detect them. Since the conclusion of the partial test ban considerable progress has been made in the fields of seismic detection. Problems, however, still remain in the fields of identification and inspection. These problems are not discussed in this paper which is confined to the problem of detection, i.e. questions related to the national systems of seismological detection.

The seismological stations are not yet optimally developed in all countries. It is surmised that if the means of detection were sufficiently developed, the problem of identification, i.e. of distinguishing between natural earthquakes and man-made explosions would be greatly facilitated.

Well equipped and well located stations can now detect events corresponding to yields of the order of one kiloton from distances up to 10.000 kilometres, covering half the globe. Hence no state has territories large enough to contain such seismic signals within its borders. The methods to record these signals seems now to be good enough to permit an adequate "national means only" solution of the detection part of the verification problem. If, however, the data emanating from the national systems were kept insulated within the national framework of each country, few of these, if any, would be large enough to monitor signals from the whole globe. To make it possible for all nations, interested in the compliance with a treaty banning

nuclear test explosions, to follow and also seek to evaluate events, presupposes availability of data from several stations in widely distributed and suitably selected locations. Such co-operation by exchange of seismological data is already internationally instituted for the purpose of monitoring and studying earthquakes.

As new and technologically much more advanced seismic stations are now being established and data flowing from them are beginning to reach the community of scientists in this field, the time has come to consider which forms further collaboration should take. We think that states, interested on one hand in furthering seismological observations and research and on the other hand in the detection of underground explosions, will find it useful to co-operate in an exchange of pertinent seismological observations. Such a "detection club" would essentially be an international data service, giving access to first class data for independent analysis.

If such co-operation is started before an underground test ban enters into force, research on the remaining test ban verification problems will be facilitated.

The last mentioned aspect has led the Swedish Government to plan certain steps to establish in Sweden appropriate resources for seismological observation and analysis. The observation data will be made available to all interested parties, and Sweden expects to get corresponding information in return.

The detection club data should preferably come from good instruments on good sites, globally distributed in advantageous positions. Although a broad participation would be desirable, such a global network could be based on seismological observations from selected stations in a rather small number of countries.

In order to broaden the uncertainty range of the absolute detection threshold facing a prospective test ban violator and thus increase the deterrence capability of seismological verification systems it is foreseen that some stations might remain outside the network of co-operating stations.

The data exchanged should comprise short messages - of the bulletin type currently used by seismologists - continuously circulated on a time scale appropriate to detection efforts. It would also be of great value if the results of calculations on bulletin data were included. The data co-operation should, furthermore, comprise the exchange, upon request, of copies of records.

Another essential element of the proposed co-operation would be the facilitation of the data exchange by the adoption of appropriate standards for instrumentation and data formats.

One will also have to consider that the existing and projected advanced seismological stations will extract a very large amount of information from the earth. To cope with this immense quantity of data it may prove necessary to establish some international co-ordinating body.

International data exchange is since long a well established practice in the geophysical sciences. The paramount importance of such co-operation for seismology has generated several national, regionally international and global schemes for the collection, analysis and exchange of data. Examples of regionally international schemes are the arrangements maintained in France, Japan, the USSR and the United States,

Indeed, much of the desiderata for the extended data exchange proposed in this paper is already met by the existing arrangements for scientific purposes. Thus, the specific needs of a "detection club" would in many cases require only adjustments of present national and international efforts.

The development of the science of geophysics and of the technique of test ban verification are closely connected. It would therefore be advantageous for all concerned to make the "detection club" data available to all scientists, to use such standards as might be sponsored by the International Council of Scientific Unions, to seek ways to achieve rapid circulation of bulletin data on some global telecommunication network accessible to scientists (e.g. the one used by the World Metereological Organization for weather data and tapped in all countries) and to achieve co-ordination as far as possible, with existing global seismological co-operative efforts, such as the International Seismological Centre at Edinburgh.

The considerations in this paper have been formulated so as to help achieve more effective seismological detection as well as to allow science to benefit from resources allocated for detection purposes and vice versa, while avoiding to place an unwanted politcal burden upon scientists.